IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants:	W.D. Grover et al.	Attorney Docket No.: LAMA121485
Application No.:	10/620302	Art Unit: 2617 / Confirmation No.: 7562
Filed:	July 14, 2003	Examiner: V. Di Prisco
Title:	PATH SEGMENT PROTECTING P-CYCLES	

APPELLANTS' APPEAL BRIEF

Seattle, Washington
July 16, 2009

TO THE COMMISSIONER FOR PATENTS:

This Appeal Brief is filed in support of the Notice of Appeal filed March 16, 2009, appealing the Examiner's final rejection dated December 16, 2008, of pending Claims 1–8, 10-22, and 24-28, and objecting to Claims 9 and 23.

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I. REAL PARTY IN INTEREST

The real party in interest is TELECOMMUNICATIONS RESEARCH LABORATORIES, which is the assignee of record. The technology is licensed to SaskTel and TELUS Corporation.

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II. RELATED APPEALS AND INTERFERENCES

None.

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III. STATUS OF CLAIMS

Claims 1-28 are pending in the application. Claims 1-8, 10-22 and 24-28 have been finally rejected, and Claims 9 and 23 have been objected to. It is this final rejection and objection that is being appealed.

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IV. STATUS OF AMENDMENTS

No amendments were filed subsequent to the final Office Action of December 16, 2008.

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V. SUMMARY OF CLAIMED SUBJECT MATTER

Throughout this document, all paragraph numbers are those of the application as published.

Claim 1 is directed to a telecommunications network (para. 7, lines 1-2, para. 35, lines 1-4, and Network T in Fig. 1(b)), comprising plural nodes (for example nodes 0-10 in Fig. 1(b), para 7, line 2) connected by plural spans (para. 7, lines 2-3, and para. 36, lines 3-5) and arranged to form a mesh network (Network T in Fig. 1(b), para. 7, line 3, and para. 35, lines 1-4), at least one pre-configured cycle of spare capacity being established in the mesh network (para. 7, lines 3-5), the pre-configured cycle (R in Fig. 1(b), also called a "p-cycle" or "flow p-cycle" throughout the specification) including plural nodes (for example, nodes 0, 2, 3, 5, 6, 8 in Fig. 1(b)) of the mesh network and being pre-configured prior to any span or node failure (para. 7, lines 6-8), and the plural nodes of the pre-configured cycle being configured to protect at least one path segment (para. 7, lines 6-8, for example path 1-3-4-2 in Fig. 2(a)), where the path segment includes at least two intersecting nodes (for example nodes 6 and 2 in path segment 6-7-2 defined by service path S1 in Fig. 1(b), para. 41, lines 4-11) within the pre-configured cycle and at least one intermediate node (para. 7, lines 10-11, for example node 7 in Fig. 1(b)) in a path (for example path 6-7-2 defined by service path S1 in Fig. 1(b)) that includes the two intersecting nodes and straddles the pre-configured cycle (para. 37, lines 8-12), the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle (para. 7, lines 1-11, and para. 42, lines 24-35).

As further set out in Claim 2, which depends on Claim 1, the path segments may be segments of a working path (for example service paths S1, S2, or S3 in Fig. 1(b)) with a start

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node (for example start node S in Figs. 2(a), 2(c)-2(e)) not connected to the pre-configured cycle (para. 7, lines 12-13).

As further set out in Claim 3, which depends on Claim 1, the path segments may be segments of a working path with an end node (for example end node E in Figs. 2(a), 2(c)-2(e)) not connected to the pre-configured cycle (para. 7, lines 13-15).

As further set out in Claim 4, which depends on Claim 1, the pre-configured cycle of spare capacity may be provided by: a) identifying all working flows in the mesh network to be restored (para. 18, line 1), b) identifying the spare capacity of the pre-configured cycle to restore all working flows for all spans subject to failure in all path segments (para. 19, lines 1-3), and c) providing spare capacity along the pre-configured cycle sufficient to restore all working flows (para. 20, lines 1-3).

As further set out in Claim 5, which depends on Claim 1, establishing a pre-configured cycle may comprise the steps of: pre-selecting a set of candidate cycles for forming into pre-configured cycles (para. 7, lines 15-18), allocating working paths and spare capacity in the mesh network based on the set of candidate cycles (para. 7, lines 18-20), and providing the mesh network with spare capacity arranged in pre-configured cycles according to the allocation determined in the preceding step (para. 7, lines 20-23).

As further set out in Claim 6, which depends on Claim 5, the allocation of working paths and spare capacity may be jointly optimized (para. 7 lines 22-23).

As further set out in Claim 7, which depends on Claim 5, pre-selecting candidate cycles may include ranking a set of closed paths in the mesh network according to the degree to which each closed path protects spans on and off the closed path, and selecting candidate cycles from the set of closed paths (para.8, lines 1-5).

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As further set out in Claim 8, which depends on Claim 7, pre-selecting candidate cycles may comprise: a) determining a scoring credit for each closed path in the set of closed paths, where the scoring credit of said closed path is calculated to predict the success of the closed path as a pre-configured cycle (para. 9, line 1, and para. 10, lines 1-4), and b) choosing a select number of closed paths based on the scoring credit to be the pre-selected candidate cycles (para. 11, lines 1-3).

As further set out in Claim 9, which depends on Claim 8 the scoring credit may be calculated by increasing said scoring credit by a value for each flow within said closed path that is protected by said closed path, increasing said scoring credit by a larger value for each flow not on said closed path that is protected by said closed path, weighting the value provided by each flow according to the traffic along said each flow and the length of each flow, and taking the ratio of said scoring credit with the cost of said closed path (para. 12, lines 1-9).

As further set out in Claim 10, which depends on Claim 5, a mixed selection strategy may be used for pre-selecting candidate cycles (para. 12, lines 9-10).

As further set out in Claim 11, which depends on Claim 1, establishing the pre-configured cycle may comprise recording at a node on a pre-configured cycle an identification of protected flow paths that pass through the node and are protected by the pre-configured cycle (para. 14, lines 1 -3 and para. 15, lines 1-3).

As further set out in Claim 12, which depends on Claim 11, protecting a path segment may comprise, upon failure of a span in a protected flow path, the node, at which the identification of the protected flow paths is recorded, routing the telecommunications traffic along the pre-configured cycle (para. 16, lines 1-5).

As further set out in Claim 13, which depends on Claim 4, the path segment may be part of a path of an express flow through a network region (para. 21, lines 1-2).

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As further set out in Claim 14, which depends on Claim 4, the pre-configured cycle may be an area boundary flow protecting *p*-cycle (para. 21, lines 2-3).

Claim 15 is directed to a method of operating a telecommunications network (para. 7, lines 1-2, para. 35, lines 1-4, and Network T in Fig. 1(b)), the telecommunications network comprising plural nodes (for example nodes 0-10 in Fig. 1(b), para. 7, line 2) connected by plural spans (para. 7, lines 2-3, and para. 36, lines 3-5) and arranged to form a mesh network (Network T in Fig. 1(b), para. 7, line 3, and para. 35, lines 1-4), the method comprising the steps of: establishing at least one pre-configured cycle of spare capacity in the mesh network (para. 7, lines 3-5), the pre-configured cycle (R in Fig. 1(b)) including plural nodes (for example, nodes 0, 2, 3, 5, 6, 8 in Fig. 1(b)) of the mesh network and being pre-configured prior to any span or node failure (para. 7, lines 6-8), and configuring the plural nodes of the pre-configured cycle to protect at least one path segment (para. 7, lines 6-8, for example path 1-3-4-2 in Fig. 2(a)), where the path segment includes at least two intersecting nodes (for example nodes 6 and 2 in path segment 6-7-2 defined by service path S1 in Fig. 1(b), para. 41, lines 4-11) within the pre-configured cycle and at least one intermediate node (para. 7, lines 10-11, for example node 7 in Fig. 1(b)) in a path (for example path 6-7-2 defined by service path S1 in Fig. 1(b)) that includes the two intersecting nodes and straddles the pre-configured cycle (para 37, lines 8-12), the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle (para. 7, lines 1-11, and para. 42, lines 24-35).

As further set out in Claim 16, which depends on Claim 15, the path segments may be segments of a working path (for example service paths S1, S2, or S3 in Fig. 1(b)) with a start

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node (for example start node S in Figs. 2(a), 2(c)-2(e)) not connected to the pre-configured cycle (para. 7, lines 12-13).

As further set out in Claim 17, which depends on Claim 15, the path segments may be segments of a working path with an end node (for example end node E in Figs. 2(a), 2(c)-2(e)) not connected to the pre-configured cycle (para 7, lines 13-15).

As further set out in Claim 18, which depends on Claim 15, the pre-configured cycle of spare capacity may be provided by: a) identifying all working flows in the mesh network to be restored (para. 18, line 1), b) identifying the spare capacity of the pre-configured cycle to restore all working flows for all spans subject to failure in all path segments (para. 19, lines 1-3), and c) providing spare capacity along the pre-configured cycle sufficient to restore all working flows (para. 20, lines 1-3).

As further set out in Claim 19, which depends on Claim 15, establishing a pre-configured cycle may comprise the steps of: pre-selecting a set of candidate cycles for forming into pre-configured cycles (para. 7, lines 15-18), allocating working paths and spare capacity in the mesh network based on the set of candidate cycles (para. 7, lines 18-20), and providing the mesh network with spare capacity arranged in pre-configured cycles according to the allocation determined in the preceding step (para. 7, lines 20-23).

As further set out in Claim 20, which depends on Claim 19, the allocation of working paths and spare capacity may be jointly optimized (para. 7, lines 22-23).

As further set out in Claim 21, which depends on Claim 19, pre-selecting candidate cycles may include ranking a set of closed paths in the mesh telecommunications network according to the degree to which each closed path protects spans on and off the closed path, and selecting candidate cycles from the set of closed paths (para. 8, lines 1-5).

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As further set out in Claim 22, which depends on Claim 21, pre-selecting candidate cycles may comprise: a) determining a scoring credit for each closed path in the set of closed paths, where the scoring credit of said closed path is calculated to predict the success of the closed path as a pre-configured cycle (para. 9, line 1, and para. 10, lines 1-4), and b) choosing a select number of closed paths based on the scoring credit to be the pre-selected candidate cycles (para. 11, lines 1-3).

As further set out in Claim 23, which depends on Claim 22, the scoring credit may be calculated by increasing said scoring credit by a value for each flow within said closed path that is protected by said closed path, increasing said scoring credit by a larger value for each flow not on said closed path that is protected by said closed path, weighting the value provided by each flow according to the traffic along said each flow and the length of each flow, and taking the ratio of said scoring credit with the cost of said closed path (para. 12, lines 1-9).

As further set out in Claim 24, which depends on Claim 19, a mixed selection strategy may be used for pre-selecting candidate cycles (para. 12, lines 9-10).

As further set out in Claim 25, which depends on Claim 15, establishing the pre-configured cycle may comprise recording at a node on a pre-configured cycle an identification of protected flow paths that pass through the node and are protected by the pre-configured cycle (para. 14, lines 1-3 and para. 15, lines 1-3).

As further set out in Claim 26, which depends on Claim 25, protecting a path segment may comprise, upon failure of a span in a protected flow path, the node, at which the identification of the protected flow paths is recorded, routing the telecommunications traffic along the pre-configured cycle (para. 16, lines 1-5).

As further set out in Claim 27, which depends on Claim 18, the path segment may be part of a path of an express flow through a network region (para. 21, lines 1-2).

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As further set out in Claim 28, which depends on Claim 18, the pre-configured cycle may be an area boundary flow protecting *p*-cycle (para. 21, lines 2-3).

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VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether Claims 1-3 and 15-17 are unpatentable under 35 U.S.C. § 103(a) over Ellinas (U.S. Patent No. 6,760,302).

Whether Claims 4-7, 10, 18-21, and 24 are unpatentable under 35 U.S.C. § 103(a) over Ellinas in view of Grover (U.S. Patent Application Publication No. 2002/0181393).

Whether Claims 8 and 22 are unpatentable under 35 U.S.C. § 103(a) over Ellinas in view of Grover, and further in view of Grover 2 (Wayne D. Grover et al., "Cycle-oriented Distributed Preconfiguration: Ring-like Speed with Mesh-like Capacity for Self-planning Network Restoration", 1998 IEEE International Conference on Communications (ICC'98), Atlanta, USA, pp. 537-543, June 7-11, 1998).

Whether Claims 11-12 and 25-26 are unpatentable under 35 U.S.C. § 103(a) over Ellinas in view of Wang (European Patent Application Publication No. EP 1,146,682).

Whether Claims 13-14 and 27-28 are unpatentable under 35 U.S.C. § 103(a) over Ellinas in view of Grover, and further in view of Wang.

Whether Claims 9 and 23 are unpatentable as being dependent upon a rejected base claim.

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VII. ARGUMENT

This is an appeal to the Board of Patent Appeals and Interferences from the final Office Action dated December 16, 2008.

In the detailed action, the Examiner rejected Claims 1-3 and 15-17 under 35 U.S.C. § 103(a) as being unpatentable over Ellinas.

Claims 4-7, 10, 18-21, and 24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ellinas in view of Grover.

Claims 8 and 22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ellinas in view of Grover, and further in view of Grover 2.

Claims 11-12 and 25-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ellinas in view of Wang.

Claims 13-14 and 27-28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ellinas in view of Grover, and further in view of Wang.

Claims 9 and 23 were objected to as being dependent upon a rejected base claim.

The Examiner has not rejected the claims based on novelty. The invention appears to be new. However, the Examiner rejected all claims as allegedly being obvious. As reiterated by the Supreme Court in *KSR*, the framework for the objective analysis for determining obviousness under 35 U.S.C. § 103 is stated in *Graham v. John Deere Co.*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). Obviousness is a question of law based on underlying factual inquiries. The factual inquiries enunciated by the Court are as follows:

> Determining the scope and content of the prior art;
>
> Ascertaining the differences between the claimed invention and the prior art; and
>
> Resolving the level of ordinary skill in the pertinent art.

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Scope and Content of Primary Reference (Ellinas)

Ellinas teaches a system of automatic protection switching for a network that protects against link or node failure (abstract). Ellinas' automatic protection switching system includes a plurality of network nodes, such as nodes 101, 103, 105, 107, 109, 111, and 113 in Fig. 1A, connected through a plurality of links. As shown in Fig. 1B, each link, such as link 85 for example, is composed of a pair of working data conduits, such as conduits 1 and 3, which carry traffic in opposite directions (Col. 2, lines 46-51).

Each link also contains a pair of protection fibers, such as fibers 17 and 19, which run in the opposite direction as one another. The protection fibers are not normally used, but are available to carry the data if needed, using protection switches in nodes at the ends of each network link. The protection switches may be activated immediately when a fault is detected adjacent to the node, resulting in recovery times on the order of 60 milliseconds (Col. 4, lines 12-14).

Referring to Fig. 3, which illustrates only the protection cycle layout of a network, each protection fiber is pre-arranged into protection cycles, such as cycles 323, 325, 327, 329, and 331. Ellinas teaches that each protection fiber is part of one and only one protection cycle (Col. 8, lines 2-4). As shown in Fig. 3, a network may be made up of a series of inner protection cycles, such as cycles 323, 325, 327, and 329, oriented in the same direction bounded by an outer protection cycle, such as cycle 331, that is oriented in the opposite direction. Protection cycles are arranged so that if a link between two nodes fails, protection switches in a transmitting node connected to the failed link will reroute a working fiber data path onto a protection cycle to arrive at the receiving node on the other side of the failed link (abstract).

Figs. 1A and 4 illustrate this system in action when the network is fully connected and in the event of a link failure, respectively. In Fig. 1A, traffic from S1 to D1 and from S2 to D2 links between nodes 105 and 111. However, in Fig. 4, a link failure 407 has occurred between

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nodes 105 and 111. Protection switches 450 and 417 reroute the working data path from S1 onto the protection cycle created by protection fibers 409, 411, and 413 to navigate around the failed link 407. Similarly, protection switches 418 and 451 reroute the working data path from S2 onto the protection cycle created by protection fibers 419, 421, and 423 to navigate around the failed link 407. As described with reference to Figs. 7-9, the protection cycles are also designed to afford limited protection against node failure to protect a priority transmission.

Ellinas' protection cycles are pre-assigned, and the protection switches are programmed to switch automatically in the event of a node or link failure (Col. 7, lines 1-10). However, in order to protect a node from link or node failure, the protection fibers of the relevant protection cycles must connect to the node in some way. Thus, to protect the network, every node and link of the network must be covered by a protection cycle (Col. 2, line 64-Col. 3, line 2). In addition, the traffic in each direction on each link is directed onto a single protection cycle if the link fails, requiring the protection cycle to have as much capacity as the working fiber in that direction on that link. Since each link must be on two protection cycles, one for each direction of working fiber, Ellinas requires 100% redundancy. Thus, Ellinas uses redundant protection fibers, in a ratio of at least one protection fiber to every working fiber, to improve the reliability performance of a network (Col. 4, lines 7-9).

Protection cycles as disclosed by Ellinas' only protect against link or node failures that are on the protection cycle itself. This is illustrated in Fig. 5, as a protection cycle defined by protection fibers 541, 543, 545, 549, and 551 is used to protect a working data path from S2 to D2 from a link failure 519 on the protection cycle itself. However, each link in Ellinas is part of two directed cycles. One directed cycle provides a restoration path for traffic in one direction on the link, and the other directed cycle provides a restoration path for traffic flowing in the other direction on the link. For example, referring again to Fig. 3, if span 333 fails, flows entering

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node 309 originally intended to go next to node 311 are diverted onto cycle 327, and reach node 311 via nodes 315 and 317. Similarly, flows entering node 311 originally intended to go next to node 309 are diverted onto cycle 323, and reach node 309 via node 305 and node 301. Cycle 331 does not supply any restoration path for this failure. See below for further discussion on the operation of Ellinas' system with reference to Fig. 4.

1. Whether Claims 1-3 and 15-17 Are Unpatentable Under 35 U.S.C. § 103(a) Over Ellinas

a. Ascertaining the Differences Between the Claimed Invention and Ellinas

The invention as claimed in Claims 1 and 15 is patentably different from Ellinas.

Claims 1 and 15 of the present application require that the plural nodes of the pre-configured cycle are configured "to protect at least one path segment, where the path segment includes at least two intersecting nodes within the pre-configured cycle and at least one intermediate node in a path that includes the two intersecting nodes and straddles the pre-configured cycle, the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle."

Applicants submit that a protection cycle as disclosed by Ellinas can only protect against link or node failures that are on the protection cycle itself, and not against the failure of a span straddling the cycle. Applicants submit that Ellinas does not disclose or suggest a protection cycle that is configured to protect a path segment that includes at least two intersecting nodes within the protection cycle and at least one intermediate node that is not part of the protection cycle. To illustrate this in Ellinas, consider the situation in Fig. 4 where a working data path is established between S1 and D1 through nodes 101, 105, and 111. A protection cycle is provided in dotted lines in a counter-clockwise direction around nodes 111, 109, 103, 101, 107, and 113.

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The working data path from S1 to D1 straddles this protection cycle, and includes two nodes 111 and 101 that intersect this protection cycle, and an intermediate node 105 that is not part of this protection cycle. However, when a link failure 407 occurs between nodes 111 and 105, this protection cycle cannot protect the working data path. In fact, Ellinas must provide another protection cycle, namely made up of protection fibers 409, 411, 413, and 431, to protect link failure 407. Thus, Ellinas achieves protection of the other nodes in the network that are not on the protection cycle by establishing multiple protection cycles to all nodes of the network.

Because Ellinas cannot protect spans that straddle a protection cycle, Ellinas' protection cycle cannot provide two restoration paths to protect against a failure of a span straddling the protected cycle.

Respectfully submitted, applicants are the first to configure a pre-configured cycle in the manner described in Claims 1 and 15 of the present application.

b. Determination of Whether the Claimed Invention Would Have Been Obvious to One of Ordinary Skill in the Art

Thus, the question to be asked is whether or not the claimed invention would have been obvious to one of ordinary skill in the art, at the time the invention was made, in consideration of the resolved Graham factual inquiries.

Applicants submit that the differences between the claimed invention and Ellinas are significant. As disclosed above, a protection cycle in Ellinas cannot protect a path segment that includes at least two intersecting nodes within the protection cycle and at least one intermediate node in a path that includes the two intersecting nodes and straddles the protection cycle, the intermediate node not being a part of the protection cycle. Instead of re-configuring the nodes in the protection cycle to protect such a path segment, Ellinas protects the other nodes and links that are not protected by the protection cycle simply by providing additional protection cycles to all

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nodes and links in the network. Ellinas uses a completely different approach than the approach taken in the instant invention as defined by Claims 1 and 15. Ellinas' approach is less sophisticated than applicants' invention as defined by Claims 1 and 15, and requires a greater amount of costly redundancy in the form of protection fibers and related components. Thus, Ellinas points away from the solution achieved by the present application, by employing a solution that is costlier and less effective. Thus, Claims 1 and 15 of the present application are not obvious in view of Ellinas.

Accordingly, it is submitted that, at the time the present invention was made, a skilled worker using the disclosure of Ellinas and their own ordinary skill, would not be able to produce the claimed invention, and thus applicants' Claims 1 and 15 are patentable over Ellinas. Claims 2-3 and 16-17 are also patentable over Ellinas, for at least their dependency from Claims 1 and 15, and for the additional subject matter they recited, as set forth in this brief in the Summary of Claimed Subject Matter.

2. <u>Whether Claims 4-7, 10, 18-21, and 24 Are Unpatentable Under 35 U.S.C. § 103(a) Over Ellinas in View of Grover</u>

a. <u>Determining the Scope and Content of the Prior Art</u>

The scope and content of Ellinas has been discussed above. Grover discloses a method of providing restoration routes for protecting traffic in a mesh network that involves generating eligible restoration routes for each span and selecting a set of restoration routes for each span based on a bi-criteria objective function (abstract).

b. <u>Ascertaining the Differences Between the Claimed Invention and the References</u>

The deficiencies of disclosure in Ellinas with respect to Claims 1 and 15 are discussed above. Nowhere in Grover is there any mention of a pre-configured cycle with plural nodes of the pre-configured cycle being configured "to protect at least one path segment, where the path

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segment includes at least two intersecting nodes within the pre-configured cycle and at least one intermediate node in a path that includes the two intersecting nodes and straddles the pre-configured cycle, the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle," as required by applicants' Claims 1 and 15.

c. <u>Determination of Whether the Claimed Invention Would Have Been Obvious to One of Ordinary Skill in the Art</u>

Again, the question to be asked is whether or not the claimed invention would have been obvious to one of ordinary skill in the art at the time the invention was made, in consideration of the resolved Graham factual inquiries.

Applicants submit that the differences between the claimed invention and the combination of Ellinas and Grover are significant. For the reasons noted above in relation to Claims 1-3 and 15-17, Ellinas does not render applicants' Claims 1 and 15 as obvious. Grover further adds nothing to Ellinas that would enable a skilled worker to produce applicants' invention as defined by Claims 1 or 15. For at least their dependency on Claims 1 and 15, Claims 4-7, 10, 18-21, and 24 are also patentably defined over Ellinas and Grover. Grover is, in fact, wholly irrelevant to the patentablity of the claimed invention.

Therefore, applicants respectfully submit that Claims 4-7, 10, 18-21, and 24 are patentable over the combination of Ellinas and Grover.

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3. Whether Claims 8 and 22 Are Unpatentable Under 35 U.S.C. § 103(a) Over Ellinas in View of Grover, and Further in View of Grover 2

a. Determining the Scope and Content of Grover 2

Grover 2 discloses span-protecting pre-configured cycles (abstract, Figs. 1a) to 1d)), and thus each pre-configured cycle protects only spans that are part of itself (Fig. 1b)) or that directly straddle (Fig. 1d)) the respective pre-configured cycle. This type of pre-configured cycle is the type referred to in the specification of the present application, specifically in paragraphs 2, 4, 36, and Fig. 1(a).

b. Ascertaining the Differences Between the Claimed Invention and Grover 2

Nowhere in Grover 2 is there any mention of a pre-configured cycle with plural nodes of the pre-configured cycle being configured "to protect at least one path segment, where the path segment includes at least two intersecting nodes within the pre-configured cycle and at least one intermediate node in a path that includes the two intersecting nodes and straddles the pre-configured cycle, the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle," as required by applicants' Claims 1 and 15.

c. Determination of Whether the Claimed Invention Would Have Been Obvious to One of Ordinary Skill in the Art

Again, the question to be asked is whether or not the claimed invention would have been obvious to one of ordinary skill in the art at the time the invention was made, in consideration of the resolved Graham factual inquiries.

Applicants submit that the differences between the claimed invention and the combination of Ellinas, Grover, and Grover 2 are significant. As stated in applicants' specification, specifically

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in paragraph 56, applicants' invention yields significant reductions in spare capacity requirements relative to span-protecting pre-configured cycle methods such as those disclosed in Grover 2. Thus, the invention as defined by Claims 1 and 15 of the present application is advantageous over Grover 2.

For the reasons noted above in relation to Claims 4-7, 10, 18-21, and 24, Ellinas and Grover do not render applicants' Claims 1 and 15 as obvious. Grover 2 further adds nothing to the combination of Ellinas and Grover that would enable a skilled worker, at the time the invention was made, to produce applicants' invention as defined by Claims 1 and 15. For at least their dependency on Claims 1 and 15, Claims 8 and 22 are also patentably defined over Ellinas, Grover and Grover 2. In fact, applicants respectfully submit that Grover 2 is wholly irrelevant to the patentability of the claimed invention.

Therefore, applicants respectfully submit that Claims 8 and 22 are patentable over the combination of Ellinas, Grover, and Grover 2.

4. Whether Claims 11-12 and 25-26 Are Unpatentable Under 35 U.S.C. § 103(a) Over Ellinas in View of Wang

a. Determining the Scope and Content of Wang

Similar to Grover 2, Wang discloses span-protecting pre-configured cycles, and thus each pre-configured cycle protects only spans that are part of itself or that directly straddle the respective pre-configured cycle (Fig. 10). This type of pre-configured cycle is referred to in the specification of the present application, specifically in paragraphs 2, 4, 36, and Fig. 1(a).

b. Ascertaining the Differences Between the Claimed Invention and Wang

Nowhere in Wang is there any mention of a pre-configured cycle with plural nodes of the pre-configured cycle being configured "to protect at least one path segment, where the path segment includes at least two intersecting nodes within the pre-configured cycle and at least one

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intermediate node in a path that includes the two intersecting nodes and straddles the pre-configured cycle, the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle," as required by applicants' Claims 1 and 15.

c. Determination of Whether the Claimed Invention Would Have Been Obvious to One of Ordinary Skill in the Art

Again, the question to be asked is whether or not the claimed invention would have been obvious to one of ordinary skill in the art at the time the invention was made, in consideration of the resolved Graham factual inquiries.

Applicants submit that the differences between the claimed invention and the combination of Ellinas and Wang are significant. As stated in applicants' specification, specifically in paragraph 56, applicants' invention yields significant reductions in spare capacity requirements relative to span-protecting pre-configured cycle methods such as those disclosed in Wang. Thus, the invention as defined by Claims 1 and 15 of the present application is advantageous over Wang.

For the reasons noted above in relation to Claims 1-3 and 15-17, Ellinas does not render applicants' Claims 1 and 15 as obvious. Wang further adds nothing to Ellinas that would enable a skilled worker, at the time the invention was made, to produce applicants' invention as defined by Claims 1 and 15. For at least their dependency on Claims 1 and 15, Claims 11-12 and 25-26 are also patentably defined over Ellinas and Wang. Wang is, in fact, wholly irrelevant to the patentability of the claimed invention.

Therefore, applicants respectfully submit that Claims 11-12 and 25-26 are patentable over the combination of Ellinas and Wang.

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5. Whether Claims 13-14 and 27-28 Are Unpatentable Under 35 U.S.C. § 103(a) Over Ellinas in View of Grover, and Further in View of Wang

a. Determination of Whether the Claimed Invention Would Have Been Obvious to One of Ordinary Skill in the Art

The scope and content of Ellinas, Grover, and Wang have been previously discussed. As with claims discussed above, the question to be asked in regard to this ground of rejection is whether the claimed invention would have been obvious to one of ordinary skill in the art at the time the invention was made, in consideration of the resolved Graham factual inquiries.

Applicants submit that the differences between the claimed invention and Ellinas, Grover, and Wang are significant. For the reasons noted above in relation to Claims 4-7, 10, 18-21, and 24, Ellinas and Grover do not render applicants' Claims 1 and 15 as obvious. Wang further adds nothing to the combination of Ellinas and Grover that would enable a skilled worker, at the time the invention was made, to produce applicants' invention as defined by Claims 1 and 15, and thus Claims 13-14 and 27-28 as well.

Therefore, applicants' Claims 1 and 15. For at least their dependency on Claims 1 and 15, Claims 13-14 and 27-28 are patentable over the combination of Ellinas, Grover, and Wang.

6. Whether Claims 9 and 23 Are Unpatentable as Being Dependent Upon a Rejected Base Claim

Applicants thank the Examiner for the indicatoin of allowable subject matter in Claims 9 and 23. For the reasons noted above in relation to Claims 8 and 22, the combination of Ellinas, Grover, and Grover 2 does not render applicants' Claims 1 and 15 as obvious.

Therefore, applicants' Claims 9 and 23 are patentable in their current form.

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Conclusion

For at least the reasons discussed above, it is submitted that applicants' invention as defined by the pending claims is unobvious in view of the combination of references presented in each rejection. It is therefore submitted that the claims on appeal are in condition for allowance, and that the claim rejections should be reversed. Action to that end is respectfully requested.

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VIII. CLAIMS APPENDIX

1. A telecommunications network, comprising:

plural nodes connected by plural spans and arranged to form a mesh network;

at least one pre-configured cycle of spare capacity being established in the mesh network, the pre-configured cycle including plural nodes of the mesh network and being pre-configured prior to any span or node failure; and

the plural nodes of the pre-configured cycle being configured to protect at least one path segment, where the path segment includes at least two intersecting nodes within the pre-configured cycle and at least one intermediate node in a path that includes the two intersecting nodes and straddles the pre-configured cycle, the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle.

2. The telecommunications network of claim 1 in which the path segments are segments of a working path with a start node not connected to the pre-configured cycle.

3. The telecommunications network of claim 1 in which the path segments are segments of a working path with an end node not connected to the pre-configured cycle.

4. The telecommunications network of claim 1 in which the pre-configured cycle of spare capacity is provided by:

a) identifying all working flows in the mesh network to be restored;

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b) identifying the spare capacity of the pre-configured cycle to restore all working flows for all spans subject to failure in all path segments;

c) c) providing spare capacity along the pre-configured cycle sufficient to restore all working flows.

5. The telecommunications network of claim 1 in which establishing a pre-configured cycle comprises the steps of:

pre-selecting a set of candidate cycles for forming into pre-configured cycles;

allocating working paths and spare capacity in the mesh network based on the set of candidate cycles; and

providing the mesh network with spare capacity arranged in pre-configured cycles according to the allocation determined in the preceding step.

6. The telecommunications network of claim 5 in which the allocation of working paths and spare capacity is jointly optimized.

7. The telecommunications network of claim 5 in which pre-selecting candidate cycles includes ranking a set of closed paths in the mesh network according to the degree to which each closed path protects spans on and off the closed path, and selecting candidate cycles from the set of closed paths.

8. The telecommunications network of claim 7 in which pre-selecting candidate cycles comprises:

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a) determining a scoring credit for each closed path in the set of closed paths, where the scoring credit of said closed path is calculated to predict the success of the closed path as a pre-configured cycle; and

b) choosing a select number of closed paths based on the scoring credit to be the pre-selected candidate cycles.

9. The telecommunications network of claim 8 in which the scoring credit is calculated by increasing said scoring credit by a value for each flow within said closed path that is protected by said closed path, increasing said scoring credit by a larger value for each flow not on said closed path that is protected by said closed path, weighting the value provided by each flow according to the traffic along said each flow and the length of each flow, and taking the ratio of said scoring credit with the cost of said closed path.

10. The telecommunications network of claim 5 in which a mixed selection strategy is used for pre-selecting candidate cycles.

11. The telecommunications network of claim 1 in which establishing the pre-configured cycle comprises recording at a node on a pre-configured cycle an identification of protected flow paths that pass through the node and are protected by the pre-configured cycle.

12. The telecommunications network of claim 11 in which protecting a path segment comprises, upon failure of a span in a protected flow path, the node, at which the identification of the protected flow paths is recorded, routing the telecommunications traffic along the pre-configured cycle.

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13. The telecommunications network of claim 4 where the path segment is part of a path of an express flow through a network region.

14. The telecommunications network of claim 4 where the pre-configured cycle is an area boundary flow protecting *p*-cycle.

15. A method of operating a telecommunications network, the telecommunications network comprising plural nodes connected by plural spans and arranged to form a mesh network, the method comprising the steps of:

establishing at least one pre-configured cycle of spare capacity in the mesh network, the pre-configured cycle including plural nodes of the mesh network and being pre-configured prior to any span or node failure; and

configuring the plural nodes of the pre-configured cycle to protect at least one path segment, where the path segment includes at least two intersecting nodes within the pre-configured cycle and at least one intermediate node in a path that includes the two intersecting nodes and straddles the pre-configured cycle, the intermediate node not being a part of the pre-configured cycle and the pre-configured cycle providing two restoration paths to protect against a failure of a span straddling the pre-configured cycle and one restoration path for a failure of a span on the pre-configured cycle.

16. The method of claim 15 in which the path segments are segments of a working path with a start node not connected to the pre-configured cycle.

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17. The method of claim 15 in which the path segments are segments of a working path with an end node not connected to the pre-configured cycle.

18. The method of claim 15 in which the pre-configured cycle of spare capacity is provided by:

a) identifying all working flows in the mesh network to be restored;

b) identifying the spare capacity of the pre-configured cycle to restore all working flows for all spans subject to failure in all path segments;

c) providing spare capacity along the pre-configured cycle sufficient to restore all working flows.

19. The method of claim 15 in which establishing a pre-configured cycle comprises the steps of:

pre-selecting a set of candidate cycles for forming into pre-configured cycles;

allocating working paths and spare capacity in the mesh network based on the set of candidate cycles; and

providing the mesh network with spare capacity arranged in pre-configured cycles according to the allocation determined in the preceding step.

20. The method of claim 19 in which the allocation of working paths and spare capacity is jointly optimized.

21. The method of claim 19 in which pre-selecting candidate cycles includes ranking a set of closed paths in the mesh telecommunications network according to the degree to which each

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closed path protects spans on and off the closed path, and selecting candidate cycles from the set of closed paths.

22. The method of claim 21 in which pre-selecting candidate cycles comprises:

a) determining a scoring credit for each closed path in the set of closed paths, where the scoring credit of said closed path is calculated to predict the success of the closed path as a pre-configured cycle; and

b) choosing a select number of closed paths based on the scoring credit to be the pre-selected candidate cycles.

23. The method of claim 22 in which the scoring credit is calculated by increasing said scoring credit by a value for each flow within said closed path that is protected by said closed path, increasing said scoring credit by a larger value for each flow not on said closed path that is protected by said closed path, weighting the value provided by each flow according to the traffic along said each flow and the length of each flow, and taking the ratio of said scoring credit with the cost of said closed path.

24. The method of claim 19 in which a mixed selection strategy is used for pre-selecting candidate cycles.

25. The method of claim 15 in which establishing the pre-configured cycle comprises recording at a node on a pre-configured cycle an identification of protected flow paths that pass through the node and are protected by the pre-configured cycle.

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26. The method of claim 25 in which protecting a path segment comprises, upon failure of a span in a protected flow path, the node, at which the identification of the protected flow paths is recorded, routing the telecommunications traffic along the pre-configured cycle.

27. The method of claim 18 where the path segment is part of a path of an express flow through a network region.

28. The method of claim 18 where the pre-configured cycle is an area boundary flow protecting *p*-cycle.

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IX. EVIDENCE APPENDIX

None.

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X. RELATED PROCEEDINGS APPENDIX

No decisions were rendered by a court or the Board in any proceeding identified pursuant to 37 C.F.R. § 41.37(c)(1)(ii).

Respectfully submitted,

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